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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/508,928	Applicant(s) ETTORE ET AL.	
	Examiner David Huang	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 September 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *21 September 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

2. The references listed in the Information Disclosure Statement filed on 9/21/2004 have been considered by the examiner (see attached PTO-1449 form or PTO/SB/08A and 08B forms).

Oath/Declaration

3. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because:

> It does not state that the person making the oath or declaration acknowledges the duty to disclose to the Office all information known to the person to be *material to patentability* as defined in 37 CFR 1.56.

Specification

4. The disclosure is objected to because of the following informalities: On page 6, line 20, and page 7, line 16, the letter "e" is used by itself between two different component value variables. This appears to be a translation problem since "e" is the Italian word for "and."

Appropriate correction is required.

Claim Objections

5. **Claims 1-15** are objected to because of the following informalities:

6. In **claim 1**, there are no transitional phrases, for example, "comprising," "consisting essentially of" and "consisting of" in the claim. The transition phrases "comprising," consisting essentially of" and "consisting of" define the scope of the claim with respect to what un-recited additional components or steps, if any, are excluded from the scope of the claims. Furthermore, where a claim sets forth a plurality of elements or steps, each element or step of the claim should be separated by a line indentation (see MPEP 608.01(m) and 37 CFR 1.75(i)).

In **claim 3**, the in-phase or real coefficient variable is inconsistent within the claim. In the formula and on line 4, the real component of the coefficient value is C_I, but on lines 6, 9, and 11, it is C_r.

In **claim 4**, there is a period and a second superfluous *original* reference, both on line 8. Periods should only be used at the end of the claim, and may not be used elsewhere except for abbreviations (see MPEP 608.01(m)).

In **claim 5**, there is a period and a second superfluous *original* reference, both on line 3. Periods should only be used at the end of the claim, and may not be used elsewhere except for abbreviations (see MPEP 608.01(m)).

In **claim 13**, there is a period and an *original* reference in the already amended claim, on lines 6-7 and 19-20. Periods should only be used at the end of the claim, and may not be used elsewhere except for abbreviations (see MPEP 608.01(m)). The *original* references and extra periods should be removed to avoid confusion.

In **claim 15**, there is a period and an *original* reference in the already amended claim, on lines 6-7. Periods should only be used at the end of the claim, and may not be used elsewhere

except for abbreviations (see MPEP 608.01(m)). The *original* references and extra periods should be removed to avoid confusion.

Claims 2 and 6-15 are objected to because they are either dependent on or refer to claim 1.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. **Claims 1-12** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In **claim 1**, applicant refers to "first extreme being formed by two known points, and second extreme being formed at least one known point." This language is indefinite since it is unclear if the known points between the first and second extremes are the same or different. It is suggested to applicant to modify to the "known points" with first, second, etc. in order to differentiate the known points. For examination on the merits, Examiner will interpret the known points to be different points.

Claims 2-12 are dependent on claim 1 and contain the same defect mentioned above.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. **Claims 1, 2, 9, 11, 13, and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al. (US Patent 6,141,393) in view of Yang (cited in IDS).

Regarding **claim 1**, Thomas et al. disclose a method for the estimation of the transfer function of at least one transmission channel in a receiving system for telecommunications networks through the computation by means of an interpolation algorithm of a plurality of channel coefficients comprised between two groups of known channel coefficients, each channel coefficient being associated to an integer value of the abscissa on a time axis characterized in that the computation of said plurality of channel coefficients is carried out by repeatedly applying an interpolation algorithm capable of calculating an intermediate point (Z, f(Z)) between a first extreme and a second extreme of a defined interval (training interval 420), said first extreme being formed two known points and said second extreme being formed by at least one known point. (Column 7, lines 41-63, Figure 4, and column 20, lines 18-35).

However, Thomas et al. fail to expressly disclose said intermediate point having as abscissa (Z) the abscissa value of the mean point between the points defining said interval rounded off to the integer closest to said first extreme, and having as ordinate (f(Z)) the arithmetic average between the ordinate of the known point of said second extreme and the ordinate of a point, chosen between two known points of said first extreme, having a distance from said intermediate point, on said time axis, equal to the distance between said intermediate point and the known point of said second extreme.

Yang discloses a linear interpolation method that adds two existing values of two given points X and Y and discards the lowest order bit of the resulting value, achieving the effect of being divided by two (column 2, lines 17-45). Because both Thomas et al. and Yang teach methods for interpolating values between known values, it would have been obvious to one of ordinary skill in the art to substitute one method for the other to achieve the predictable result of interpolating an intermediate value.

Regarding **claim 2**, Thomas et al. disclose everything claimed as applied to claim 1 above, and further disclose said channel coefficients to be calculated are comprised between a first known channel coefficient, of abscissa A, corresponding to a last pilot symbol of a current slot (L) and a second known channel coefficient, of abscissa B, corresponding to a first pilot symbol of a slot (L+1) subsequent to said current slot, being additionally known a third channel coefficient, of abscissa A-1, on the left-hand of said first channel coefficient of abscissa A (training interval 420, Figure 4; column 5, lines 1-5), and the computation of said channel coefficients is carried out through the following steps:

a) repeatedly applying in a recursive manner said interpolation algorithm in the interval defined by said known channel coefficients of abscissa A and B, by carrying out a first iteration in which a first intermediate coefficient (of abscissa C) is calculated (column 20, lines 56-67);

b) searching, by increasing abscissas, for a first point, still to be calculated, on the right-hand of the last intermediate coefficient calculated; and further applying, in a recursive manner, said interpolation algorithm to said new interval, by carrying out subsequent iteration of the same algorithm in sub-intervals defined from time to time by the intermediate coefficient calculated in

the preceding iteration, until the point immediately adjacent to the left-hand extreme of said new interval is reached and calculated (column 21, lines 4-7);

c) repeating step b) until the channel coefficient associated to the value of abscissa B-1 is calculated (column 21, lines 7-9).

However, Thomas et al. fails to expressly disclose by performing the subsequent iterations of the same algorithm in sub-intervals, defining each time on the left-hand by said known channel coefficient of abscissa A and on the right-hand by the intermediate coefficient, calculated in the preceding iteration, until the abscissa point A+1 is reached and computed; defining as extremes of a new application interval of said interpolation algorithm, the first known left-hand point and the first known right-hand point with respect to said point still to be calculated; and carrying out subsequent iteration of the same algorithm in sub-intervals defined from time to time by the intermediate coefficient calculated in the preceding iteration, until the point immediately adjacent to the left-hand extreme of said new interval is reached and calculated.

Yang discloses a step of selectively substituting the resulting value discarded from the lowest order bit for one of the two existing values of the two given points X and Y in accordance with the digit of the highest order bit in a binary representation of the position pointer K; a step of repeating the previous two steps until the lowest order bit in the binary representation of the position pointer K is used; and a step of achieving the interpolation value of the target point I from one of the two resulting values discarded from the lowest order bit of the two given points X and Y (column 2, lines 26-35). Because both Thomas et al. and Yang teach methods for interpolating pilot values within an interval it would have been obvious to one of ordinary skill in

the art to substitute one method for the other to achieve the predictable result of interpolating an intermediate value. Furthermore, it would have been obvious to repeatedly apply the bisection interpolation method taught by Yang for each sub-interval in order to calculate pilot values for the entire interval since Thomas et al. teaches repeating the interpolation for an entire interval (column 21, line 7-9), and the bisection method taught by Yang reduces both complexity and time in operation (column 2, lines 12-16).

Regarding **claim 9**, see the rejection for claim 2. Claim 9 is an obvious variant of claim 2 in that it reverses the order in which the values within the interval are interpolated. Since the bisection interpolation method taught by Yang employs the use of position pointer K, any value within the interval can be selected for interpolation and it would required only routine skill in the art to reverse the order the values in the interval are interpolated.

Regarding **claim 11**, Thomas et al. disclose everything claimed as applied to claim 1 above, and further disclose at least one known point of said first or second extreme is a point which has been obtained through a linear combination of known channel coefficients (column 20, lines 36-55).

Regarding **claim 13**, Thomas et al. disclose a device for the estimation of the transfer function of a transmission channel in a receiving system for a telecommunications network, comprising:

a memory (100) capable of storing channel coefficients corresponding to a current slot (L) and at least one channel coefficient corresponding to a slot (L+1) subsequent to said current slot (L) (Filtering Matrix Memory Unit 520, Figure 5);

interpolation means (104, 106, 108, 110) capable of reading from said memory (100) a first and a second operand, corresponding to known channel coefficients (Matrix Multiplier 530, Figure 5);

a logic control unit (102) for addressing in reading and writing (R/W) said memory (100) and for controlling said interpolation means (104, 106), so as to perform through individual interpolation operations, the computation and the storage into such memory (100) of individual channel coefficients; characterised in that said logic control unit (102) carries out a series of interpolation operations according to the method described in claim 1 (Microprocessor 540, Figure 5; see rejection for claim 1).

However, Thomas et al. fails to expressly disclose writing into said memory (100) a value corresponding to the arithmetic average between said first and second operand, said value corresponding to a new channel coefficient.

Yang discloses registers A and B (10 and 20), adder 30 and multiplexer 40 (Figure 2). The values in registers A and B are added in adder 30 and the lowest order bit of the resulting value is discarded to form a mean value of the two. The mean value is then sent to the multiplexer 40 and depending on the value of position pointer K, the mean value is sent to one of two registers.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the device taught by Thomas et al. with the interpolation circuit taught by Yang since it reduces complexity in the circuit and reduces operation time (column 2, lines 12-16).

Regarding **claim 15**, Thomas et al. disclose a mobile terminal, of the type comprising a receiver for the reception of signals coming from a radio base station (Figure 1, column 6, lines 47-64), equipped with a device for the estimation of the transfer function of a transmission channel through the computation of a plurality of channel coefficients (Channel Estimation Device 208, Figure 2), characterised in that said estimation of the transfer function is performed. according to the method described in claim 1 (see rejection for claim 1).

11. **Claim 14** is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al. (US Patent 6,141,393) in view of Yang (cited in IDS) as applied to claim 1 above, and further in view of and Schmidl et al. (US Patent Application Publication 2002/0006158).

Regarding **claim 14**, Thomas et al. disclose a radio base station for receiving signals coming from mobile terminals (Figure 1, column 6, lines 47-64), equipped with a device for the estimation of the transfer function of a transmission channel through the computation of a plurality of channel coefficients (Channel Estimation Device 208, Figure 2), characterised in that said estimation of the transfer function is performed according to the method described in claim 1 (see rejection for claim 1).

However, Thomas et al. and Yang fail to expressly disclose that the radio base station is of the type comprising a Rake receiver.

It is well known in the art that a rake receiver has individual demodulators (fingers, tracking units) used to track separate paths and combines the finger outputs to improve signal-to-noise ratio, as evidenced by Schmidl et al. (page 1, [0010]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the base station taught by Thomas et al. with a rake receiver since

it is well known in the art that rake receivers improve signal to noise ratio thereby improving reception.

12. **Claims 3-8** are rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al. (US Patent 6,141,393) in view of Yang (cited in IDS) as applied to claim 2 above, and further in view of Dobrica (US Patent 5,875,215).

Regarding **claim 3**, Thomas et al. and Yang disclose everything claimed as applied to claim 2 above, but fail to expressly disclose each slot contains three pilot symbols (0, 1, 2), said first known channel coefficient of abscissa A is the coefficient $C(2)=C_I(2)+C_Q(2)$ corresponding to the last pilot symbol (2) of the current slot (L), said second known channel coefficient of abscissa B is the coefficient $C(10)=C_r(10)+C_Q(10)$ corresponding to the first pilot symbol (10) of a subsequent slot (L+1), and said third known channel coefficient of abscissa A-1 is the coefficient $C(1)=C_r(1)+C_Q(1)$ corresponding to the last but one pilot symbol (1) of the current slot (L) and the computation of channel coefficients $C(k)=C_r(k)+C_Q(k)$, with k=3 . . . 9, is performed according to the following sequence:

$C_I(6)=[C_I(2)+C_I(10)]/2$; $C_Q(6)=[C_Q(2)+C_Q(10)]/2$;

$C_I(4)=[C_I(2)+C_I(6)]/2$; $C_Q(4)=[C_Q(2)+C_Q(6)]/2$;

$C_I(3)=[C_I(2)+C_I(4)]/2$; $C_Q(3)=[C_Q(2)+C_Q(4)]/2$;

$C_I(5)=[C_I(4)+C_I(6)]/2$; $C_Q(5)=[C_Q(4)+C_Q(6)]/2$;

$C_I(8)=[C_I(6)+C_I(10)]/2$;$C_Q(8)=[C_Q(6)+C_Q(10)]/2$;

$C_I(7)=[C_I(6)+C_I(8)]/2$; $C_Q(7)=[C_Q(6)+C_Q(8)]/2$;

$C_I(9)=[C_I(8)+C_I(10)]/2$; $C_Q(9)=[C_Q(8)+C_Q(10)]/2$.

Nevertheless, Yang et al. does disclose the bisection interpolation method using the expression (X+Y)/2 to calculate interpolated values.

Dobrica discloses the number of pilot symbols of each frame (slot) normally ranges from 1 to 5 (column 6, lines 56-58), and a base band linear modulated received signal having a complex number value is used for estimation of a multiplicative distortion arising from fading. An in-phase component and a quadrature component of a multiplicative distortion arising from fading I/Q are low-pass processed so that they may be suitably used for I/Q estimation of a multiplicative distortion (column 6, lines 18-22). Interpolation for an I component and a Q component of a fading multiplicative distortion is performed (column 7, lines 28-29). Thus, it is implicitly disclosed to interpolate both in-phase and quadrature components of the base band pilot signals.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the combination of Thomas et al. and Yang with the I/Q interpolation taught by Dobrica since the magnitude of amplitude information obtained by such a method, that is, the magnitude of a multiplicative distortion of a complex number value, can also be used for precision automatic gain control (AGC) without a burden of the cost (column 6, lines 25-29). Furthermore, at the time the invention was made it would have been an obvious matter of design choice to a person of ordinary skill in the art to specify 3 pilot symbols as claimed because Applicant has not disclosed that using 3 pilot symbols provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Dobrica's range of pilot symbols, and applicant's invention, to perform equally well with either the range of pilot symbols or the claimed three pilot symbols because

both would perform the same function of providing extreme values for interpolating values in between training intervals.

Regarding **claims 4-8**, the number of pilots in each slot would have been an obvious matter of design choice to a person of ordinary skill in the art, as is established in claim 3 above.

13. **Claim 10** is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al. (US Patent 6,141,393) in view of Yang (cited in IDS) as applied to claim 1 above, and further in view of Horiguchi (US Patent 5,903,280).

Regarding **claim 10**, Thomas et al. disclose everything claimed as applied to claim 1 above, and further disclose said channel coefficients to be calculated are comprised between two known left-hand channel coefficients, corresponding to the last two pilot symbols of a current slot (L), and two known right-hand channel coefficients, corresponding to the first two pilot symbols of a slot (L+1) subsequent to said current slot, and the computation of said channel coefficients is performed by applying the first time said interpolation algorithm for calculating an intermediate coefficient, thus dividing into two sub-intervals the interval comprised between said known left-hand channel coefficients and said known right hand channel coefficients (column 7, lines 41-63, Figure 4, and column 20, lines 18-35; multiple known pilot symbols in each training interval is taught implicitly).

However, Thomas et al. and Yang fail to expressly disclose subsequently applying, in parallel, to said sub-intervals said interpolation algorithm for computing the remaining channel coefficients comprised in each of said sub-intervals.

Horiguchi disclose the an output can be made faster when an interpolation processing for generating display information for n scanning lines is performed in parallel units of scanning lines (column 10, line 66 – column 11, line 4).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the interpolation taught by Thomas et al. and Yang in parallel to sub-intervals as claimed since performing interpolation processing in parallel makes calculations faster.

14. **Claim 12** is rejected under 35 U.S.C. 103(a) as being unpatentable over Thomas et al. (US Patent 6,141,393) in view of Yang (cited in IDS) as applied to claim 1 above, and further in view of Doetsch et al. (US Patent Application Publication 2002/0141483).

Regarding **claim 12**, Thomas et al. and Yang disclose everything claimed as applied to claim 1, but fail to expressly disclose said communications network is a radio mobile telecommunications network of UMTS type.

However, it is well known in the art that UMTS CDMA mobile radio systems use pilot symbols to estimate the channel impulse response as is evidenced by Doetsch et al. (page 1, [0004]-[0005]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to specify the telecommunications network as a UMTS type since it is well known in the art that UMTS CDMA systems use pilot signals for determining the channel impulse response and the interpolative method taught by Thomas et al. and Yang provide improved channel impulse response estimation during periods pilot signals are not transmitted.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Huang whose telephone number is (571) 270-1798. The examiner can normally be reached on Monday - Friday, 8:00 a.m. - 5:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on (571) 272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

DSH/dsh
8/9/2007

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